

## CLAIMS

1. An apparatus for determining the type of liquid in a container comprising:
  - a heat source disposed outside a container;
  - a temperature sensor disposed near said heat source for converting the temperature of an outer wall of said container into a voltage or a current;
  - a notification means capable of issuing an alert indicating that the content of said container is dangerous; and
  - a control determination circuit whereby the supply of power to said heat source is controlled, the difference between the value of an output of said temperature sensor at time  $t_1$  which is before or upon the supply of power to said heat source and the value of an output of said temperature sensor at time  $t_1+t_2$ , which is when a predetermined time has elapsed after said time  $t_1$ , is compared with a predetermined threshold value, and an alert signal is outputted to said notification means.
2. The apparatus for determining the type of liquid in a container according to claim 1, wherein said control determination circuit comprises:
  - a timer;
  - a power supply circuit capable of supplying power to said heat source;
  - a notification signal generating circuit for outputting said alert signal to said notification means;
  - an AD converter for converting an output of said temperature sensor into digital data;
  - a data storage unit for recording a program and data; and
  - an arithmetic processing unit for carrying out processes in accordance with said program recorded in said data storage unit,wherein said program causes said arithmetic processing unit to carry out:
  - a first procedure in which, on the condition that no power is being

supplied from said power supply circuit to said heat source, the current time  $t_1$  is acquired from said timer, and in which data is acquired from said AD converter and recorded in said data storage unit as a value  $SO_1$ ;

a second procedure in which a control signal to said power supply circuit is switched to an ON signal for supplying power to said heat source, and, after a predetermined time has elapsed, the control signal is switched to an OFF signal  $M$  for supplying no power to said heat source;

a third procedure in which the current time is acquired from said timer and in which it is determined whether or not the thus acquired current time exceeds a time  $t_1+t_2$  which is the sum of said time  $t_1$  and an elapsed time  $t_2$ ;

a fourth procedure in which, if it is determined that the current time exceeds the time  $t_1+t_2$  in the third procedure, data is acquired from said AD converter and recorded in said data storage unit as a value  $SO_2$ ;

a fifth procedure in which the difference  $SO_2-SO_1$  between said values  $SO_1$  and  $SO_2$  is calculated and compared with a predetermined threshold value; and

a sixth procedure in which said alert signal is outputted from said notification signal generating circuit depending on the result of comparison between the difference  $SO_2-SO_1$  and the threshold value.

3. The apparatus for determining the type of liquid in a container according to claim 1, wherein said control determination circuit comprises:

a lamp circuit for producing a lamp voltage in response to a signal indicating the start of measurement;

a first latch circuit for latching the value of an output of said temperature sensor when the absolute value of an output of said lamp circuit is  $|V_1|$ ;

a power supply circuit that starts the supply of power to said heat source when the absolute value of the output of said lamp circuit is  $|V_2|$  which is larger than said  $|V_1|$  and terminating said supply of power after a predetermined time has

elapsed;

a second latch circuit for latching the value of an output of said temperature sensor when the voltage of said lamp circuit reaches  $|V3|$  which is larger than said  $|V2|$ ;

a differential amplification circuit to which the outputs of said first latch circuit and said second latch circuit are inputted; and

a notification signal generating circuit for comparing an output of said differential amplification circuit with a predetermined threshold value and outputting said alert signal to said notification means.

4. The apparatus for determining the type of liquid in a container according to any one of claims 1 to 3, wherein said heat source and said temperature sensor are disposed away from the wall of said container.

5. The apparatus for determining the type of liquid in a container according to claim 4, wherein said heat source is a halogen heater and said temperature sensor is an infrared thermopile.

6. The apparatus for determining the type of liquid in a container according to claim 5, wherein a light-absorbing heat shield member is disposed between said heat source and said temperature sensor.

7. The apparatus for determining the type of liquid in a container according to any one of claims 1 to 6, further comprising a container sensor for detecting the placement of said container, wherein a signal from said container sensor is used as a trigger for initiating determination.

8. A method for controlling an apparatus for determining the type of liquid in a container, said apparatus comprising: a heat source disposed outside said

container; a temperature sensor disposed near said heat source for converting the temperature of an outer wall of said container into a voltage or a current; a notification means capable of issuing an alert indicating that the content of said container is dangerous; and a control determination circuit, said method comprising the steps of:

storing or holding the value of an output of said temperature sensor at time  $t_1$ ;

starting the supply of power to said heat source at time  $t_3$  which is later than said time  $t_1$ ;

terminating the supply of power to said heat source at time  $t_4$  which is after said time  $t_3$ ;

storing or holding the value of an output of said temperature sensor at time  $t_5$  which is later than said time  $t_3$ ;

finding the difference between the value of an output of said temperature sensor at time  $t_1$  and the value of an output of said temperature sensor at time  $t_5$ ;

comparing the difference with a predetermined threshold value; and

issuing an alert to said notification means depending on the result of comparison between the difference and the threshold value.

9. The control method according to claim 8, wherein said time  $t_5$  is later than said time  $t_4$ .

10. The control method according to claim 8 or 9, wherein said apparatus for determining the type of liquid in a container further comprises a container sensor for detecting the placement of said container,

wherein the processes after said time  $t_1$  are started using a signal from said container sensor as a trigger.

11. The control method according to any one of claims 8 to 10, wherein said heat

source and said temperature sensor are disposed away from the wall of said container.

12. The control method according to claim 11, wherein said heat source is a halogen heater and said temperature sensor is an infrared thermopile.

13. The control method according to claim 12, wherein a light-absorbing heat shield member is disposed between said heat source and said temperature sensor.

14. An apparatus for determining the type of liquid in a container comprising:

- one or a plurality of flexible films in contact with a container;
- a temperature sensor provided to the single film or one of said plurality of films;
- a heat source provided either to the same film as or a different film from the single film or one of said plurality of films to which said temperature sensor is provided;
- a notification means capable of issuing an alert indicating that the content of said container is dangerous;
- a power supply means for supplying power to said heat source;
- an arithmetic comparison means whereby a comparison value is calculated by acquiring an output of said temperature sensor and compared with said threshold value;
- an alert signal output means for outputting an alert signal to said notification means depending on the result of comparison by said arithmetic comparison means; and
- a control means for controlling said power supply means, said arithmetic comparison means, and said alert signal output means.

15. The apparatus for determining the type of liquid in a container according to

claim 14, wherein said film is curved and disposed such that the peak of the curvature is facing toward a plane on which said container is placed, wherein as said container is placed, said heat source and said temperature sensor are pressed against the outer wall of said container due to the flexibility of said film.

16. The apparatus for determining the type of liquid in a container according to claim 15, comprising either a first configuration in which the curved surface of said film is in contact with said container along a line in the direction of the height of said container, or a second configuration in which said curved surface is in contact with said container along a line in the circumferential direction of said container.

17. The apparatus for determining the type of liquid in a container according to claim 14, wherein said film is disposed along the outer wall of said container.

18. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 17, wherein said temperature sensor is smaller than said heat source.

19. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 18, comprising a plurality of heat sources, wherein said temperature sensor is disposed between said plurality of heat sources.

20. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 19, wherein said heat source and said temperature sensor are comprised of electric resistor elements patterned on said film.

21. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 20, wherein said control means:

controls said power supply means such that it supplies power to said heat source at time t1 and terminates the power supply at time t2 which is later than said time t1;

measures an output value O1 of said temperature sensor at time t3 and an output value O2 of said temperature sensor at time t4 which is later than said time t3 and t1; and

calculates said comparison value from said output value O2 and said output value O1.

22. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 20, wherein said control means:

controls said power supply means such that it supplies power to said heat source at time t1 and terminates the power supply at time t2 which is later than t1;

measures an output value O3 of said temperature sensor at time t6 which is earlier than time t5 at which said container is placed, an output value O4 of said temperature sensor at time t7 which is later than said time t5 and earlier than said time t1, an output value O1 of said temperature sensor at time t3, and an output value O2 of said temperature sensor at time t4 which is later than said time t3 and t1;

determines a correction value from said output values O4 and O3; and

calculates said comparison value from said output values O2 and O1 and said correction value.

23. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 20, wherein said control means:

controls said power supply means such that it supplies power to said heat source at time t1 and terminates the power supply at time t2 which is later than said time t1;

measures an output value O3 of said temperature sensor at time t6 which

is earlier than time t5 at which said container is placed, an output value O1 of said temperature sensor at time t3, and an output value O2 of said temperature sensor at time t4 which is later than said time t3 and t1; and

calculates said comparison value from said output values O2, O1, and O3.

24. The apparatus for determining the type of liquid in a container according to any one of claims 14 to 20, further comprising a second temperature sensor disposed such that it is in contact with said container away from said heat source by a distance greater than the distance between said heat source and said temperature sensor, wherein said control means:

controls said power supply means such that it supplies power to said heat source at time t1 and terminates the power supply at time t2 which is later than said time t1;

measures an output value O1 of said temperature sensor at time t3, an output value O2 of said temperature sensor at time t4 which is later than said time t3 and time t1, and an output value O5 of said second temperature sensor at time t8 which is earlier than said time t4; and

calculates said comparison value from said output values O2, O1, and O5.

25. The apparatus for determining the type of liquid in a container according to claim 24, wherein said second temperature sensor is an electric resistor element patterned on said film.

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26. The apparatus for determining the type of liquid in a container according to claim 24 or 25, wherein said second temperature sensor is disposed at a position circumferentially displaced from the position where said temperature sensor and said heat source are disposed.

27. The apparatus for determining the type of liquid in a container according to



any one of claims 14 to 26, further comprising a container sensor for detecting the placement of said container, wherein determination is started using a signal from said container sensor as a trigger.

28. A method for controlling an apparatus for determining the type of liquid in a container comprising:

- one or a plurality of flexible films in contact with a container;
- a temperature sensor provided to the single film or one of said plurality of films;

- a heat source provided either to the same film as or a different film from the single film or one of said plurality of films to which said temperature sensor is provided;

- a notification means capable of issuing an alert indicating that the content of said container is dangerous;

- a power supply means for supplying power to said heat source;

- an arithmetic comparison means whereby a comparison value is calculated by acquiring an output of said temperature sensor and compared with said threshold value;

- an alert signal output means for outputting an alert signal to said notification means depending on the result of comparison by said arithmetic comparison means; and

- a control means for controlling said power supply means, said arithmetic comparison means, and said alert signal output means, said method comprising the steps of:

- storing or holding an output value O1 of said temperature sensor at time t3;

- starting the supply of power to said heat source at time t1;

- terminating the power supply to said heat source at time t2 which is later than said t1;

storing or holding an output value O2 of said temperature sensor at time t4 which is later than said time t3 and time t1;

determining said comparison value from said output values O1 and O2;

comparing said comparison value and said threshold value; and

generating said alert signal depending on the result of comparison.

29. A method for controlling an apparatus for determining the type of liquid in a container comprising:

one or a plurality of flexible films in contact with a container;

a temperature sensor provided to the single film or one of said plurality of films;

a heat source provided to the same film as or a different film from the single film or one of said plurality of films to which said temperature sensor is provided;

a notification means capable of issuing an alert indicating that the content of said container is dangerous;

a power supply means for supplying power to said heat source;

an arithmetic comparison means whereby a comparison value is calculated by acquiring an output of said temperature sensor and compared with said threshold value;

an alert signal output means for outputting an alert signal to said notification means depending on the result of comparison by said arithmetic comparison means; and

a control means for controlling said power supply means, said arithmetic comparison means, and said alert signal output means, said method comprising the steps of:

storing or holding an output value O3 of said temperature sensor at time t6 which is earlier than time t5 at which said container is placed;

storing or holding an output value O4 of said temperature sensor at time t7

which is later than said time t5;

storing or holding an output value O1 of said temperature sensor at time t3 which is later than said time t7;

starting the supply of power to said heat source at time t1 which is later than said time t7;

terminating the power supply to said heat source at time t2 which is later than said time t1;

storing or holding an output value O2 of said temperature sensor at time t4 which is later than said time t3 and time t1;

determining a correction value from said output values O3 and O4;

determining said comparison value from said output values O1 and O2 and said correction value;

comparing said comparison value and said threshold value; and

producing said alert signal depending on the result of comparison.

30. A method for controlling an apparatus for determining the type of liquid in a container comprising:

one or a plurality of flexible films in contact with a container;

a temperature sensor provided to the single film or one of said plurality of films;

a heat source provided either to the same film as or a different film from the single film or one of said plurality of films to which said temperature sensor is provided;

a notification means capable of issuing an alert indicating that the content of said container is dangerous;

a power supply means for supplying power to said heat source;

an arithmetic comparison means whereby a comparison value is calculated by acquiring an output of said temperature sensor and compared with said threshold value;

an alert signal output means for outputting an alert signal to said notification means depending on the result of comparison by said arithmetic comparison means; and

a control means for controlling said power supply means, said arithmetic comparison means, and said alert signal output means, said method comprising the steps of:

storing or holding an output value O3 of said temperature sensor at time t6 which is earlier than time t5 at which said container is placed;

storing or holding an output value O1 of said temperature sensor at time t3 which is later than said time t6;

starting the supply of power to said heat source at time t1 which is later than said time t6;

terminating the power supply to said heat source at time t2 which is later than said time t1;

storing or holding an output value O2 of said temperature sensor at time t4 which is later than said time t3 and time t1;

determining said comparison value from said output values O1, O2, and O3;

comparing said comparison value and said threshold value; and

producing said alert signal depending on the result of comparison.

31. A method for controlling an apparatus for determining the type of liquid in a container comprising:

one or a plurality of flexible films in contact with a container;

a temperature sensor provided to the single film or one of said plurality of films;

a heat source provided to the same film as or a different film from the single film or one of said plurality of films to which said temperature sensor is provided;

a notification means capable of issuing an alert indicating that the content of said container is dangerous;

a power supply means for supplying power to said heat source;

an arithmetic comparison means whereby a comparison value is calculated by acquiring an output of said temperature sensor and compared with said threshold value;

an alert signal output means for outputting an alert signal to said notification means depending on the result of comparison by said arithmetic comparison means;

a control means for controlling said power supply means, said arithmetic comparison means, and said alert signal output means; and

a second temperature sensor disposed in contact with said container away from said heat source by a distance larger than the distance between said heat source and said temperature sensor, said method comprising the steps of:

storing or holding an output value O1 of said temperature sensor at time t3;

starting the supply of power to said heat source at time t1;

terminating the power supply to said heat source at time t2 which is later than time t1;

storing or holding an output value O2 of said temperature sensor at time t4 which is later than said time t3 and t1;

storing or holding an output value O5 of said second temperature sensor at time t8 which is later than said time t4;

determining said comparison value from said output values O1, O2, and O5;

comparing said comparison value and said threshold value; and

producing said alert signal depending on the result of comparison.

32. The method for controlling the apparatus for determining the type of liquid in

a container according to any one of claims 28 to 31, wherein said heat source and said temperature sensor are electric resistor elements patterned on said film.

33. The method for controlling the apparatus for determining the type of liquid in a container according to container 31, wherein said heat source, said temperature sensor, and said second temperature sensor are electric resistor elements patterned on said film.

34. The method for controlling the apparatus for determining the type of liquid in a container according to any one of claims 28 to 33, wherein said apparatus for determining the type of liquid in a container comprises a container sensor for detecting the placement of said container, wherein processes are started using a signal from said container sensor as a trigger.